Symons's
Meteorological Magazine.

No. 577. FEBRUARY, 1914. Vol. XLIX.

NOTES ON THE CYCLONE OF OCTOBER 27th, 1913, IN CHESHIRE.

By A. H. Hignett.

A storm which did an immense amount of damage passed through Cheshire at about 8.30 p.m. on October 27th. It was preceded, and accompanied by, very heavy rain, which, together with the lateness of the hour and small population of the district, may account for there having been no human casualties. The few people who heard it describe the sound as that of "hundreds of motor cars crashing through the trees." It lasted 4½ minutes, and its track was about 150 yards wide. It was accompanied by very vivid lightning, which ran about over the ground, and was said to be prismatic in colour. The wind is described as a "warm wind," whereas the wind in South Wales, where the cyclone occurred on the same afternoon, was said to be icy cold.

After doing much damage in the neighbourhood of Wem and Whitchurch, in the north of Shropshire, the cyclone, which was travelling in a due northerly direction, appears on entering the county of Cheshire to have risen into the air, and passed over about seven miles of country, most of which is covered with very fine timber, without doing any damage. It then pounced down on a single tree standing alone in a field near Bulkeley Grange, smashing it to pieces. It then rose again for a further 1¼ miles, doing no damage until it reached a farm at Peckforton Moss, which lies at the foot of the Peckforton Hills, a range of hills about 600 to 700 feet above sea level. On first returning to the earth it appears to have divided into two tracks, which passed on either side of the farm-house, destroying all the trees and buildings on each side, but leaving the house undamaged. These tracks joined again about half-a-mile or so further on, and the cyclone then travelled along the foot of the hills in a line parallel to them.

It was here that the worst damage was done. The country is thickly covered with very fine timber, and for a distance of over a mile hardly a single large tree was left standing in the track of the

cyclone, 150 yards wide, any small ones which were not uprooted having most of their branches torn off. One large uprooted tree was found in the centre of a field, and could not be identified; it had evidently been carried a considerable distance.

In several parts of the track of the cyclone the trees were laid down in *every* direction, which, with the way the tops were screwed off—many trees having only the trunks standing—would point to the "whirlwind" nature of the storm.

As the Church Stretton cyclone (referred to in your article on "The Weather of October") occurred at 8 p.m., and was apparently travelling north via Wem and Whitchurch, it might be the same cyclone which reached Cheshire (about 40 miles distant) at 8.30 p.m.

Several cows were lifted over a high hedge into an adjoining field, and three of them killed. Hen houses, pigsties and hay barns were carried away bodily, the galvanized iron sheets and the dead bodies of the hens being found hung up in the branches of the fallen trees.

The whole of the nearly new glass-houses and vineries in the gardens of Peckforton Castle, which lie in a very sheltered spot at the foot of the hill, were carried away, and some of the glass was found two miles further on, whereas, at the Castle itself, nothing was heard or known of the storm until the following morning.

The Castle stands on the top of the hill about 200 feet above and 400 to 500 yards to the west side of the track of the cyclone.

It then travelled past the foot of the rock on which the ruins of Beeston Castle stand, unroofing a farm on its eastern side, and continued in a northerly direction, doing much damage at Willington Hall, Kelsall, and eventually passed into Lancashire, near Runcorn.

THE WEATHER OF JANUARY.

DURING the first few days of the month the southern half of the British Islands was under the influence of a large anti-cyclonic system, while pressure was low in the vicinity of the Azores and in the far north. The month opened with low temperature, the shade minima on the 1st being as low as 10° at West Linton, 11° at Llangammarch Wells, 15° at York, 16° at West Witton, and 17° at Fulbeck, Marlborough, and Birr Castle; at Guernsey, on the other hand, the minimum did not fall below 34°. On the 3rd the influence of the high pressure system, which had receded over the Bay of Biscay, became reduced, and rain fell very generally over the western and northern districts. On the 4th a spell of unsettled weather set in which lasted till the 9th, during which time our islands were affected by deep cyclonic systems passing eastward at no great distance from our northern coasts. Gales were experienced almost daily on many parts of the northern and western coasts, with thunder-

THAMES VALLEY RAINFALL — JANUARY, 1914.

Symons's Meteorological Magazine.

Watershed of River Thames above Teddington, and River Lee above Feildes Weir

Rainfall Stations reporting •

Isohyetals

storms on the 5th and 6th in Ireland and Scotland. On the 4th heavy rain fell in many western districts, the maximum falls reported being 1·66 in. at Dungeon Ghyll, 1·36 in. at Carsphairn and 1·30 in. at Ottershaw. On the 8th, 2·1 in. fell at Stonyhurst, 1·8 in. at Lancaster, and 1·5 in. at Poltalloch, many other places in the west having falls ranging from an inch to an inch and a half. From about the 11th to the 23rd very little rain fell over the greater part of the United Kingdom, which was under the influence of a large anticyclonic system that had moved over our islands from Northern Europe. Temperature at the beginning of this period was above the normal, with maxima exceeding 50° in some southern districts, but later fell considerably. Easterly winds predominated, and in the north and east slight showers of snow and sleet were experienced. The lowest temperature occurred on varying dates. In Scotland the minimum values were mostly observed on the 21st or 22nd, the lowest recorded, all on the later date, being 15° at Balmoral, 16° at Fort Augustus, and 17° at Strathpeffer; in most other districts the minimum readings took place on the 23rd or 24th, temperature falling at Marlborough to 10° on the 23rd, and to 15° at Harrogate, Cirencester and Wisley, on the 24th. On this day temperature was high over Ireland and the N.W. of England, which was under the influence of a cyclonic disturbance located near Iceland; the shade maxima rising to 55° at Foynes, and to 54° at Birr Castle and Hawarden, while over practically the whole of Ireland the thermometer on this day rose above 50°. In the S.E. of England and the Channel Islands day readings continued low, the maximum at Hastings being only 36°.

Heavy rain fell on the 24th and 25th at many of the normally wet areas in the Lake District and the west of Scotland, the maximum amounts recorded being 2·85 in. at Seathwaite and 2·12 in. at Dungeon Ghyll on the 24th; 3·22 in. (in 12 hours) at Fort William, 1·75 in. at Loch Stack and 1·58 in. at Meggernie on the 25th. During the last week of the month southerly and westerly winds predominated, temperature being much above the normal in most districts. Rainfall was heavy in the north and east of Scotland, but in the east and south-east of England, which was dominated by the continental high pressure system, little fell. The highest temperatures recorded were 57° at Markree Castle on the 25th, and Hawarden Bridge on the 31st, on which day values of 56° in the shade were observed at many places in the N.E. of England, the Midland Counties and the south of Ireland. During the last three days of the month heavy rain fell in many northern and western districts, the maximum falls reported being 2·20 in. at Blaenau Festiniog, and 1·66 in. at Seathwaite on the 29th; 1·47 in. at Bendamph on the 30th; and 1·73 in. at Treherbert on the 31st.

The general rainfall of the month, expressed as a percentage of the average, was:—England and Wales, 67; Scotland, 92; Ireland, 61; British Isles, 73.

ROYAL METEOROLOGICAL SOCIETY.

THE annual general meeting of the Society was held on January 21st at the Institution of Civil Engineers, Westminster, Mr. C. J. P. Cave, President, in the chair.

In the report for the year 1913, the Council note a slight diminution in the number of Fellows. Among the losses by death are included M. Leon Teisserenc de Bort who was presented with the Symons Gold Medal in 1908, and Sir Wm. H. Preece, F.R.S., the eminent electrician of the Post Office who was elected a Fellow so long ago as 1862. The Joint Committee of the Society and of the British Association has continued its researches in the upper air and a brief report was made to the last meeting of the Association in Birmingham. The co-operation with the Meteorological Office in the preparation of a series of normal values of the climatological elements of the British Isles has been continued. Barometric pressure and wind direction were first dealt with and the Council has decided that on publication the pressure values shall be given in millibars, the question whether they shall also be given in inches being still under consideration. The additions to the library during the year included 284 volumes and 226 pamphlets, charts, etc. The report was adopted on the motion of the President.

Dr. Shaw proposed a vote of thanks to the Council for their work during the year. He referred to the new pressure units adopted by the Council, and said he had been pleased to note that the United States Weather Bureau had on January 1st commenced the publication of charts of barometric pressure for the Northern Hemisphere, on which the values were expressed in millibars.

The following gentlemen were elected to serve on the Council for the 1914 session. *President:* Mr. C. J. P. Cave, M.A.; *Vice-Presidents:* Dr. C. Chree, F.R.S., Dr. H. N. Dickson, Mr. E. Gold, Capt. H. G. Lyons, D.Sc., F.R.S.; *Treasurer:* Mr. F. Druce; *Secretaries:* Mr. F. Campbell Bayard, LL.M., Commr. W. F. Caborne, C.B.; *Foreign Secretary:* Dr. R. H. Scott, F.R.S.; *Councillors:* Mr. W. W. Byrant, Mr. R. H. Hooker, Mr. Baldwin Latham, C.E., Mr. R. G. K. Lempfert, Lt.-Col. H. Mellish, Mr. R C. Mossman, Col. H. E. Rawson, C.B., Hon. F. A. R. Russell, Mr. C. Salter, Capt. A. Simpson, Mr. G. I. Taylor, Commr. D. Wilson-Barker.

An interesting event in the evening's proceedings was the presentation of the Symons Gold Medal to Mr. W. H. Dines, F.R.S., in recognition of his distinguished work in meteorological science. The President spoke in glowing terms of Mr. Dines's valuable researches and especially his work with kites and pilot balloons in the investigation of the upper atmosphere. In returning thanks to the Society, Mr. Dines referred to his friendship with the late Mr. Symons, and reviewed the advances in meteorology in the past 30 or 40 years.

Mr. C. J. P. Cave delivered his Presidential address on "Upper Air Research." He described the way in which the upper air has

been explored in this and other countries. The first known experiments were made in 1749 by Dr. A. Wilson who raised thermometers by suspending them on a kite line. In 1847 kites were first flown at Kew Observatory in an endeavour to measure temperature and wind velocity in the upper air. It was not until 1895 that the Hargreave box-kite was evolved and this has since been used generally in most upper air experiments. Since the invention by Mr. Dines of a light meteorograph, valuable instrumental records have been obtained by means of small balloons of light fabric. At Manchester 24 balloons were sent up carrying Dines's meteorographs on one day at hourly intervals. Mr. Cave said that Great Britain was badly situated for upper air research as many balloons travelled out to sea and the records were in consequence lost. In the United States the late Lawrence Rotch induced the Weather Bureau to organize 17 stations for making upper air experiments and this soon became part of ordinary work of the American Observatories. Various instrumental means of obtaining records were described including Teisserenc de Bort's apparatus for collecting rarified air at great heights. To the late Teisserenc de Bort must be given the honour of having discovered the troposphere and the stratosphere though his results were at first received with some incredulity.

At the International Meteorological Conference, in 1896, it was decided to periodically fix certain days upon which ascents would be made simultaneously in various countries. More recently international weeks have been arranged, the first being held in July, 1907. Valuable contributions to the knowledge of the upper air conditions have been made by scientists in Russia, France and Germany. Germany posseses at Lindenberg the most complete upper air Observatory in the world. In 1912 there were made at Lindenberg 26 ascents of registering balloons, 262 of captive balloons, and 516 of kites.

The upper air has also been explored in the antarctic by Dr. G. C. Simpson, who accompanied the late Capt. Scott. Useful work has also been done by the Prince of Monaco on his arctic and other cruises.

Dr. Chree proposed a hearty vote of thanks to Mr. Cave for his address and for his services as President during the past year.

The following new fellows were elected:—Mr. Francis Anderson, Lieut. R. Cholmondeley, Mr. B. D. Cursett, B.Sc., B.A., Mr. Gilbert Dennison, Mr. H. E. Hurst, M.A., B.Sc., Mr. L. S. Powell, Capt. Robert Sunter, Mr. J. G. Sutherland, M.A.

SCOTTISH METEOROLOGICAL SOCIETY.

A Meeting of the Society was held in the Goold Hall, Edinburgh, on the evening of Monday, 26th January, 1914, when Mr. J. Mackay Bernard, B.Sc., President of the Society, presided over a large attendance.

Mr. A. Watt, Secretary to the Society delivered a Popular Lecture on "Ocean Currents and their Influence on Climate."

After a rapid outline of the development of our knowledge of ocean currents from the days of Columbus to the voyage of the "Michael Sars," the main facts as to the principal currents were summarised, and it was submitted that in sub-tropical regions the great currents had a direct influence on climate both as regards temperature and rainfall. Thus under the influence of the "return currents" of the North Atlantic and North Pacific the coasts of Morocco and of California had much cooler climates than the lands in the same latitudes on the western sides of the oceans.

There were marked similarities in the physical features of the great oceans, and these were very striking as regards the movements of their waters. Up the western coasts of South America, South Africa and Australia there flowed cold currents, which were not in any sense true antarctic currents, but were due to the uprising from lower depths of cool water to replace the warm waters driven off-shore by the powerful south-east Trade Winds. With these cold currents were associated practically rainless conditions along the shores washed by them. The Indian Ocean and China Sea were the only regions in which seasonal inversions of direction of currents occurred, and along the coastal fringe of Somaliland the air temperature was actually slightly less high in summer than in winter, as a consequence of the cold current which appeared off the coast to take the place of the warm water driven off-shore by the powerful South West Monsoon. Minor causes of currents such as convection movements and variations in salinity and density were discussed. Maury and his school had greatly over estimated such factors, and they were of importance chiefly in the case of partially enclosed seas. The great currents of the globe were determined by the prevailing winds. The Japan Current and the Gulf Stream were alone true ocean rivers, and the latter had entirely lost its momentum and had practically disappeared a little to the east of the Newfoundland Banks. The warm water that reached the shores of North-Western Europe was mere surface water driven across the Atlantic by the prevailing south-westerly winds which were themselves the main cause of the remarkable mildness of our climate. Any influence the Gulf Stream had on our climate was not direct as Croll and others had argued, but indirect. It was, of course, the Icelandic "low" in conjunction with the permanent "high" over the Azores that determined the frequency and strength of our south-westerly winds, and in so far as the intensity of that "low" depended on the surface temperature of the North Atlantic we had to take into account the contribution of warm water made by the Gulf Stream. It seems possible, however, that for any "long range" temperature forecasts for our islands we should look not to the Gulf Stream so much as to the Labrador Current which was a powerful factor in determining the temperature of the Atlantic surface waters.

INTERNATIONAL BALLOON ASCENTS.

By W. H. DINES, F.R.S.

March 1st, 1911.

Starting Point.	Country.	A (H_0.) miles.	B (T_0.) ° F.	C miles.	D ° F.	E miles.	F
Manchester.....	England ..	6·3	—71	11·9	—67	125	S.E. by E.
Brussels	Belgium ..	6·0	—60	16·4	?	78	S. by E.
Hamburg	Germany..	5·9	—47	14·4	?	53	E.N.E.
Lindenberg	„ ..	5·9	—57	8·6	—55	53	E.N.E.
Paris	France ...	6·5	—49	10·5	—53	109	E.
Munich	Germany..	7·5	—69	8·0	—68	269	E.
Pavia	Italy	7·1	—74	8·4	—69	58	E.
Pavlovsk	Russia	6·5	—81	8·4	—63	21	E.
Nishni Olchedaeff	„ ..	6·1	—53	7·6	—52	9	N.E.

March 2nd, 1911.

Manchester.....	England ..	7·3	—83	8·6	—63	138	S.E.
Petersfield	„ ..	6·9	—90	7·5	—91	417	E. by S.
Lindenberg.....	Germany..	5·3	—66	8·5	—51	56	S.E. by E.
Paris	France ..	6·4	—73	8·9	—60	119	E.S.E.
Munich	Germany..	5·7	—70	8·3	—54	108	S. by W.
Nizhni Olchedaeff	Russia	5·7	—58	6·9	—47	21	S.E.

March 3rd, 1911.

Manchester.....	England ..	6·9	—68	9·4	—54	141	S.E.
Brussels	Belgium ..	7·1	—92	8·3	—71	146	S. by E.
Lindenberg	Germany..	4·8	—54	8·5	—50	63	E.S.E.
Paris	France ..	6·8	—75	8·9	—64	111	S. by E.
Vienna.....	Austria ..	5·1	—61	6·5	—49	48	S.S.E.
Pavlovsk	Russia	4·7	—55	7·4	—42	30	E. by N.
Nishni Olchedaeff	„	5·2	—64	6·9	—47	14	N.N.E.

A Height in miles of commencement of isothermal column.
B Temperature, F°., at bottom of column.
C Greatest height of reliable record in miles.
D Temperature, F°., at greatest height.
E Distance in miles of point where balloon fell.
F Bearing of falling point from starting point.

On the first a deep and extensive depression lay to the west of Norway and a high pressure over Russia, and another over Spain. On the second the whole northern system had moved eastward, and the Spanish anticyclone had extended to the Alps. The anticyclone had hardly moved on the third, but a very deep depression was rapidly approaching from Iceland.

The temperatures are very irregular, unusually high over Paris and Hamburg on March 1st, unusually low over England on the 2nd. There was a very general but irregular drift to the east and south-east, the most common direction over Europe for the drift of the upper atmosphere.

WIND GUSTS AND AERONAUTICS.

At a joint meeting of the Aëronautical Society of Great Britain, and the Royal Meteorological Society, held in the Royal United Service Institution, on January 7th, Major-General R. M. Ruck, C.B., R.E. (ret.), in the Chair, Dr. W. N. Shaw, F.R.S., delivered an Illustrated Address on "Wind Gusts and the Structure of Aerial Disturbances."

The subject being one of great interest and importance to practical aviators there was a good attendance. Dr. Shaw at the outset referred to the very great difficulty in handling the subject of the evening's discourse. He summarised the more salient features of the investigation as follows: "gusts are the expression of turbulent motion in the atmosphere. They are most conspicuous near the surface and may be attributed to the effect of obstacles, interposed in the path of moving air, which change the uniform motion of a steady current into pulsating motion with eddies. The most fully-developed form of eddy motion in the atmosphere is the cliff eddy. In other cases the vortices rapidly disintegrate, and so far the eddy motion has not lent itself to numerical measurement. Eddy motion is found in persistent forms and can arise spontaneously in the free atmosphere probably in consequence of thermal convection. The elements of eddy motion to be found in a line squall may give rise to temporary eddies with a vertical axis. Local convection in the atmosphere must inevitably give rise to local differences of pressure and hence to local winds which are shown in anemometers as recurring squalls. Consequently the causes and origin of recurring squalls should be looked for in the thermal changes due to local convection."

METEOROLOGICAL NEWS AND NOTES.

The Rev. H. A. Boys draws our attention to some remarkable sunsets which he has seen during the past winter. We shall be glad to have reports from other Observers who have any noteworthy optical phenomenon to describe.

Dr. W. N. Shaw, F.R.S., at the request of the Council of the Royal Society of Edinburgh, recently delivered an address on "Principia Atmospherica: a Study of the Circulation of the Atmosphere." A special appeal for the encouragement of the further study of the science of meteorology in "all seminaries of sound learning and particularly the Universities of this land" was made.

At Eastbourne, on Sunday, January 25th, Mr. J. C. Stenning reports that: "trees and other objects presented a peculiar greenish brown look, owing to their being covered with dust not due to road traffic. I put some of it under the microscope, and the examination showed it consisted of very fine sand grains. The dust came with a south-west wind."

THE UNITED STATES DAILY WEATHER MAP for January 1st, is accompanied by a notice stating that the U.S. Weather Bureau began on that date the publication of a weather map of the northern hemisphere, which will appear on the reverse side of the usual morning weather chart. In the specimen sent, the units of the C. G. S. system have been adopted. Pressures are expressed in millibars, and temperatures in absolute units. We further note that in the daily summaries, accompanying the Weekly Weather Report of the London Meteorological Office, references to air temperature over Europe have, since January 4th, been given in absolute units.

A BRILLIANT METEOR was seen on January 19th, at Farnham, Surrey, by Colonel Chrystie. "At about 7·5 p.m. there was suddenly a brilliant light. For a moment I thought a motor was coming up behind. Then I noticed a brilliant patch in the sky, N.W. about 75°; the sky being overcast. The light lasted a second or two, and must have been a meteor. I heard Farnham Parish Church strike seven a few minutes before. About 5 minutes later there was a peal of distant thunder, also in the N.W. The interval was so great that there can have been no connection between this and the light."

THE MAXIMUM SHADE TEMPERATURE in the Glaisher Stand at Camden Square has, at the time of writing, exceeded 50° on every day since January 29th, a sequence of 16 days. In the last 56 years the greatest number of consecutive days with shade maxima exceeding 50°, hitherto observed during the first eight weeks of the year, was 12, viz., from January 3rd to 14th, 1873.

THE MILDNESS OF THE WINTER is shown by the following, for which we are indebted to Mr. E. W. Harris, the High School, Malvern. "Your readers may be interested to know that 15 fully-ripe raspberries were gathered in the garden on December 12th last and strawberries were collected in the immediate neighbourhood on Xmas day. The following kinds of roses have been gathered in the open in Malvern during the month of January, viz., Gloire de Dijon, Maman Cochet, Dean Hole, Isabella Sprunt, Soeur de Marie de Zazay, Richmond, White Killarney, Madame Abel Chatenay, G. Nabonand, Frau Karl Druschki.

THE SOUTH ORKNEY RELIEF PARTY left Buenos Aires on January 13th. Observations at this important station—the most southerly observatory in the world—have now been carried on under Argentine auspices for ten years, the meteorological and magnetic work initiated by Dr. Bruce, of the *Scotia* expedition in 1903, having been taken over in February, 1904, by Mr. W. G. Davis, Director of the Argentine Meteorological Office. As no less than four antarctic expeditions will shortly be exploring in the Weddell Sea area, the combined meteorological and magnetic results will be of great interest and will throw much additional light on the weather problems of this region.

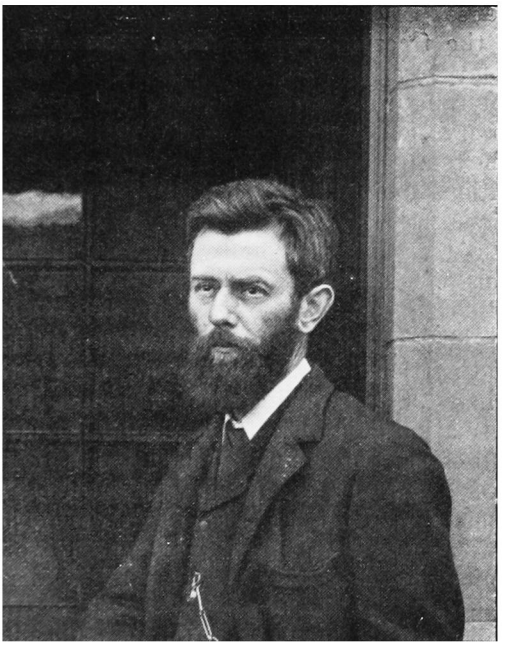
Robert Traill Omond, LL.D.

1858—1914.

By the death of Dr. R. T. Omond, which took place on the morning of January 27th, at his house in Edinburgh, at the comparatively early age of 55, the science of meteorology has lost one of its most earnest workers. Dr. Omond received his education at the Collegiate School of Edinburgh, and at the University. Although not pursuing any of the regular courses qualifying for degrees, he specialised in the study of physics under Prof. Tait, to whom he rendered invaluable assistance in the research work dealing with the compression of liquids, which arose out of the interpretation of the deep sea temperatures taken on the *Challenger* expedition. He also studied geology under Sir Archibald Geikie. In 1883, Dr. Omond became associated with the important enterprise which a year later resulted in the establishment of the famous Ben Nevis Observatory, of which he was installed Superintendent. During the succeeding eleven years he devoted himself in the most whole-hearted and self-sacrificing manner to the development of this great scientific undertaking. As automatic instruments were of no use during the greater part of the year, owing to the excessive humidity, frozen fogs and snowdrift, Dr. Omond initiated a system of hourly eye observations which were maintained night and day without interruption for a period of 20 years, until the closing of the observatories in 1904. Although a paid official under the Ben Nevis directors, he himself contributed towards the upkeep of the observatories sums far exceeding his small nominal salary.

Never of a robust constitution his health suffered under the continued strain of the rigorous climatic conditions prevailing on the cloud-capped summit, and in 1895 he was reluctantly compelled to give up work at the high level station, taking the title of Honorary Superintendent. On his return to Edinburgh, Dr. Omond, in conjunction with Dr. Buchan, gave all his time and energies to the working out of the many important problems which the wealth of Ben Nevis data rendered practicable. He prepared and saw through the press the four quarto volumes containing the detailed observations (*Trans. Roy. Soc., Edin.*, Vols. **36, 42, 43, 44**). In this work the main labour of proof correction rested with him, and, in addition to this self-imposed task, he contributed many papers to the appendices to these volumes and to the Journal of the Scottish Meteorological Society. His early training under Tait enabled him to bring to bear on his research work a full knowledge of fundamental physics, with which he was able to elucidate many of the atmospheric phenomena prevailing in the great laboratory of Nature. He became a Fellow of the Royal Society of Edinburgh in 1884, was awarded the Keith Prize in 1892, and served one term (1901-1904) on the Council. The honorary degree of Doctor of Laws was conferred on him at the summer graduation of 1913 by the University of Edinburgh.

Although the Ben Nevis enterprise absorbed much of his energies his wide scientific outlook caused him to have deep practical interests in many other directions. He was one of the most liberal supporters of the Scottish National Antarctic Expedition, and in spite of the burden of the Ben Nevis proof reading saw most of the papers dealing with the discussion of the *Scotia* Antarctic Meteorology through the press. Although suffering for years from a serious illness, his bright optimistic spirit continued unimpaired to the very end. When we saw him last, early in October, his appetite for work, despite the limitations imposed by physical disabilities, remained as



keen as ever, and he outlined at some length a heavy piece of research which he hoped to carry through during the winter.

Possessed of a genial, sympathetic, and happy spirit which to the last never failed him, he endeared himself to all. His influence over those who had the privilege of working with him in the early Ben Nevis days was enduring, and those who spent longer or shorter periods on the summit engaged in ordinary routine or special research, carried away lasting recollections of his unfailing courtesy and kindness, which made all visitors feel at home as his guests. He has left us an enduring example of tenacity of purpose and high ideals, combined with a simple, direct, and cheerful life which won the admiration and respect of his many friends. R. C. M.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GLAZED FROST.

MAY I be allowed to add a contribution to the discussion on the above rather complicated subject; first with regard to the possibility of rain-drops being cooled below the freezing point without becoming solid. There seems to be every reason for supposing that this does take place, indeed they cannot freeze till they have been cooled some degrees below the freezing point as there is no solid surface in them of a nature of a freezing nucleus. I have no observations of the temperature of rain-drops during a glazed frost at low level, but I made some observations on cloud particles on the Rigi Kulm in 1892. At the time the temperature was 27° F. after a night minimum of 24°. In these conditions the particles seen falling on the micrometer were liquid. Previous to that date I had shown that artificially formed cloud particles were liquid though the temperature of the air in which they were condensed was 6° below freezing. Super-cooling of rain-drops will, therefore, be possible, as the condensation nucleus will not act in them, as it does not act in cloud particles, as a freezing nucleus; cloud particles being really very small rain-drops, and are constantly falling. Super-cooling may, therefore, in some cases take part in the formation of glazed frost, though it does not seem to be necessary in all cases. Mr. Dines explanation of rain-drops falling on surfaces cooled below 32°, and it may be formed even when the air temperature has risen above 32°, seems to be the explanation of most of the glazed frosts we have in this part of the world, but does not seem to explain what takes place occasionally here but more frequently elsewhere. For instance the thick coating of ice which sometimes forms on both small and large branches of trees, and even on grass stems, seem to require some other explanation, as the cooling effect of the twigs or the grass could not freeze a perceptible coating of ice. These cases would seem to require either super-cooling—would not "infra," "sub," or "subter," be a more correct prefix in this case—of the rain-drops, or else rain falling from a warm overstratum into a layer of air below 32° at the earth's surface.

In answer to Mr. Gold's question as to whether the freezing of a super-cooled rain-drop begins at its outer surface or not, the probability seems to be that it will begin at its outer surface, the start being given possibly by an angular speck of dust caught in the lower air by the falling drop, and once started ice spicules will almost instantaneously shoot through the whole drop, accompanied by a rise in its temperature to 32°.

JOHN AITKEN.

Ardenlea, Falkirk, 21st January, 1914.

I HAVE read Mr. Gold's letter with interest. The real point at issue in the present discussion is, I think, this :—rain drops or ice pellets, or a mixture of both, are falling at a time when apparently snow-flakes ought to be falling instead; why is this the case? To consider first the super-cooled water side of the question. If, as is no doubt usually the case in a typical glazed frost produced by rain-drops alighting on a frozen soil, the surface stratum of air through which the drops must fall is also at a temperature below the freezing point, it is, of course, quite possible that super-cooling will occur, and the calculations of Mr. Gold concerning the rate of cooling of falling rain-drops show, moreover, that it will be very probable. But what has meanwhile happened to the missing snow-flakes which ought to be falling in such cold weather? Either they were never formed at all in the condensation region, or else they were melted on the way down. Snow, I suppose all will be agreed, is the product of the crystallization of aqueous vapour out of the atmosphere, and it is almost inconceivable that liquid drops could freeze into such flakes. When once vapour is condensed (and the one sure criterion of condensation is the liberation of heat and not visibility) it must on freezing take a form much harder and more compact than snow, viz., hail, graupel or plain spherules—what I call "ice-rain."

Now it so happens, as Mr. Dines also pointed out, that the general meteorological conditions are usually such as to enable us very easily to account for the missing snow-flakes on occasions of glazed frost, or "silver thaw." A warm current overhead is either generating *rain* in the region of condensation, or melting the snow beneath that region. At the same time, of course, super-cooling, as we saw above, may be a secondary result in so far as the rain may fall through the cold surface air without freezing into solid pellets.

May not the difficulty which Mr. Gold has, in face of his calculations, in accounting for the readiness with which the drops escape solidifying, be explained by viscosity or friction?

On January 17th, 1912, we were not entirely robbed of our snow-flakes, and I think the large encrustations of ice upon twigs and branches, which were the characteristic feature of that rather remarkable and unusual type of glazed frost, must have resulted from the peculiar consistency of wet snow which fell in London on the night of the 17th (a time of deep snow in the Midlands).

I was quite mindful of the fact, drawn attention to by Mr. Gold, that the temperature on the afternoon of January 11th, 1913, when I observed the ice spherules, did not fall to freezing, but as the temperature was about 37° I did not regard the conditions of the phenomenon as essentially different, and concluded that only a little way up in the free air it would probably be below 32° in a layer beneath a warmer one, causing rain and cutting of the south of England from the north country snowstorm.

L. C. W. BONACINA.

Hampstead, N.W., January 20th, 1914.

THE STEVENSON SCREEN.

DURING the last 35 years I have been specially interested in the subject of thermometer screens, and have made frequent experiments thereon, one or two of the early results of which I showed to the late Mr. G. J. Symons many years ago.

I entirely endorse Mr. R. H. Curtis' defence, in your December number, of the Stevenson Screen and maintain, with Mr. John Aitken, that its disagreement with the north verandah readings of Mr. A. O. Walker is no indication of "error," but is, on the contrary, a point in its favour.

The "second top" protection against transmitted heat, mentioned by Mr. Aitken in your January number, has long been an essential part of the orthodox "Stevenson," as indeed, so far as I know, of any pattern of screen, and the underneath protection from reflected radiant heat is almost equally important.

As to the Scottish experiments mentioned in Mr. Aitken's letter, I am inclined to doubt the fairness of the artificial current of air for obtaining true shade temperature, and I do not agree that "Stevenson" readings, as such, are ever necessarily too high.

While, however, regarding the desirability of the Stevenson Screen for ordinary use as "chose jugée," I have, as the result of much labour, devised and constructed three others for use with (1) glass mounted thermometers, (2) "Alpine" thermometers for travellers, and (3) specially protected "pocket" thermometers, with all of which screens, notwithstanding their smallness and portability, I obtain readings closely approximating to those of the "Stevenson" itself.

WM. B. BUTLER.

Old Southgate, N., 19th January, 1914.

MAY I add a few remarks to the discussion on the Stevenson Thermometer Screen, and measurements of the air temperature. The first is that it is absolutely futile to use a thermometer hung *anywhere near a wall* for comparison with anything. The heavy mass of stone retains heat, and also cold, for a very long time. Consequently after any considerable change of temperature, objects within reach of its radiation will have their temperature very markedly affected. Some years ago, when living near Durham, I had a thermometer exposed on the wall of the house, the bulb being about 4 inches from the wall, and another at the end of the garden about 50 ft. distant, on the north side of an open trellis-work summer house. One evening after a heavy snowfall (in February, 1893, I believe) the sky cleared and a very severe frost set in. At 10 p.m. the thermometer on the wall read 13°; that at the end of the garden read 3°. If temperature had risen suddenly there would have been as great a difference the other way about.

My other point is that to attempt to measure the "temperature of the air" with great accuracy on a sunny day is to attempt the im-

possible, for it is attempting to measure a quantity which does not exist. The temperature of the air during sunshine is a thing of shreds and patches. No two adjacent masses of air then have the same temperature, nor does any one mass keep the same temperature for many seconds at a time. To prove this it is only necessary to attempt to use a large telescope for look-out purposes on a sunny day. I have two large astronomical telescopes, a 5 in. refractor and a $10\frac{3}{4}$ in. reflector. On a cloudy day these can be used with tremendous effect on distant terrestrial objects. At a mile I can see the separate florets of a daisy flower, small insects and spider threads on a hedge, &c. On a sunny day nothing can be seen but a dancing mass of confused air currents. The confusion is due to differences of temperature between closely adjacent air masses. The air at such times is a mixture of many temperatures and no thermometer is delicate enough to respond to the rapid and fitful changes of these. All that we can do is to get a fairly accordant mean. No contrivance for blowing air through can do any more. The accuracy which some of your correspondents are striving for is a spurious and fallacious accuracy. The effect of closing the bottom of the screen is merely to divert the current of heated air which rises from the sun-warmed ground. But if there is any breeze at all the same current from the ground to windward of the screen will be entering by the louvres on that side.

W. F. A. ELLISON.

Fethard-on-Sea, Waterford, January 21st, 1914.

SUDDEN FALL OF TEMPERATURE.

FOLLOWING upon the two remarkably warm days of January 9th and 10th, there occurred at midnight on the latter date a sudden and very brisk fall in temperature, amounting to 20° in eight hours, and accompanied by marked changes in humidity. The following table shows the two-hourly changes in temperature, and humidity as deduced from the hygrograph trace, a copy of which is enclosed herewith.

	Dry.	Wet.		Relative Humidity.
	°	°		%
January 10th, 12 p.m.	50	49	.....	93
,, 11th, 2 a.m.	42	40	.....	85
,, ,, 4 ,, ...	37	35	.....	83
,, ,, 6 ,, ...	33	31	.....	78
,, ,, 8 ,, ...	30	29	.....	83

There was a light and steady S.W. surface wind until 9 p.m. on the 10th, when it had become a very light westerly air. By 12.45 a.m. on the 11th a further change through N.W. to N. took place, finally becoming N.E. at 8 a.m. and moderate in force. At 4 p.m. on the 9th, during a very temporary period of partial clear sky, a rapidly moving cirrus current was noticed from the N.E. A black N.E. type of weather prevailed to the 22nd, with slight snow flurries at

times, very thick hoar frost setting in on the evening of that date, the grass radiation thermometer falling to 5° on the morning of the 23rd. Further thick rime frosts on the 23rd and 24th have been followed by a southerly wind with misty rain.

SPENCER C. RUSSELL.

Five Oaks, Billingshurst, Sussex, January 26th, 1914.

VISIBILITY.

HAVING observed and recorded Visibility since the year 1891, I may, perhaps, be able to make some reply to Mr. S. Miller's questions.

During the period mentioned, extreme visibility has been recorded at 9 a.m. on 83 occasions, and on 29 of them, or 35 per cent., measurable rain has fallen in the course of the following 24 hours. But the average number of rain days in the year, during the same period, has been 151, or 41 per cent. The phenomenon would, therefore, appear not to be a prognostic of rain, but rather the contrary.

As to the conditions which produce it, I do not venture to say anything, except that it seems to occur most frequently with north-easterly or easterly winds. Thirty-eight of the instances, nearly half, were with the wind between N. and E. This conclusion, however, can only be regarded as true locally. I believe that observations at stations situated S.W. of London show a totally different result.

H. S. TABOR.

Fennes, Braintree, 29th Dec., 1913.

LUNAR HALO.

AT 6.15 p.m. yesterday, Sunday, 4th January, I noted here a very clear and distinct rainbow coloured halo around the moon. There was a fresh wind blowing from the south at the time with fleecy white clouds drifting across the sky, but when first observed the sky was clear. The halo colours ranged from purple at the outer diameter to red, violet, orange and light green, the outside diameter of the halo being about 10 diameters of the moon's disc. The barometer at the time was 28·9 in., having fallen from 29·1 in. at 8 a.m., and the shade temperature 47°.

About half-an-hour afterwards the rings had extended in diameter somewhat, and the colouring was not so distinct as previously, and very soon after this the sky became too cloudy for observation.

During the night of the 4th, and early morning of the 5th the wind increased and became squally with rain at times. At 8 a.m. this morning, barometer steady at 28·6 in., with calm atmosphere.

HY. HULSE.

Engineer and Surveyor's Department, Droitwich, 5th January, 1914.

THE LARGE IONS OF THE ATMOSPHERE.

SOME recent discussions on the above subject have shown, among other things, that:—(*a*) A greater number of large ions are present in the atmosphere during moderate rain than during heavy rain; (*b*) A greater number of large ions are present during snow than during rain.

The similarity between the behaviour of the large ions and water or ice particles suggest that either they are identical, or that our methods of counting them do not distinguish between them. The latter seems to me the more likely, and may explain (*a*) and (*b*).

(*a*) Apart from the growth of water drops by condensation upon them as they fall, large numbers must coalesce. The greater the height at which the drops are formed the fewer will there be below a certain size by the time they reach the Earth. Consequently, there may be far more drops falling during moderate or low-formed rain than during heavy or high-formed rain. Obviously the heavy drop cannot masquerade as an ion, but we are not sure that the small drop cannot.

(*b*) Let there be two equal and separate regions in the atmosphere forming precipitation at equal rates—the one water and the other ice particles. These will start falling, and on the way to earth will experience many collisions. In the case of the water drops—apart from growth by condensation—a large percentage of the collisions will result in coalescence; whereas in the case of the ice particles a large percentage of the collisions will result in rebounds. Consequently after a time there will be far more ice particles below a certain size than water particles, and therefore a greater *apparent* "large ionisation" in the ice particle region.

It would be interesting to know if there is a greater apparent "large ionisation" during snow formed at comparatively low levels than in that formed at high levels. Also whether the maximum apparent "large ionisation" during rain and snow occurs early or late during the shower.

ALBERT GENDLE.

South Kensington, January 23rd, 1914.

NOVEMBER MILDNESS—AND AFTER.

IT has been asserted in the papers lately that mild Novembers are usually followed by cold winters; a fair number of examples have also been cited which, if typical, seem to bear out this theory.

Any predictions so far ahead is, of course, open to grave doubt, but, having Greenwich records for 1900—1911 inclusive and also for 1894—1895, I have attempted to find an approximate connection between the November mean and the coldness of the following winter, taken to be during December, January and February. I realise, of course, that any method using arbitrary periods must be approximate, so I must crave the indulgence of your readers.

The chief point is how to fix the intensity of the winter numerically. This might be done in four ways by—

(1) The total number of degrees of frost; (2) The number of frosts; (3) The mean frost intensity; (4) The mean duration of frost periods.

Any of the above considered alone reveal nothing when plotted to a base of November means. When, however, the product of (3) and (4) is plotted to the same base the result is quite different and a rough curve results, from which it is apparent that the higher a

	November Mean, Greenwich.	No. of Frost Days.	Degrees of Frost in Dec., Jan., Feb. following	Average Intensity.	Average Duration.	Product.
1895	46°4	54	39°2	7°26	5°4	39°2
1900	46·1	33	140·4	4·30	6·6	28·4
1901	40·9	37	159·3	4·03	2·6	11·2
1902	44·2	19	80·1	4·02	3·2	13·4
1903	44·1	30	98·0	3·27	3·7	12·1
1904	41·6	21	94·2	4·48	2·1	9·4
1905	41·1	24	78·0	3·25	2·4	7·8
1906	45·9	42	20·1	4·80	4·2	20·2
1907	44·8	25	14·8	5·87	2·8	16·4
1908	45·9	35	205·7	5·86	5·1	29·8
1909	41·7	28	101·6	3·62	2·0	7·2
1910	38·9	18	80·2	4·05	2·2	10·0
1911	43·8	14	87·2	6·23	2·5	15·5

November mean the colder is the following winter. To fix one's ideas, note the intense winter of 1894—95, with a value of 39°·2, following a November mean of 46°·4, and the mild winter of 1910—1911, with a value of 10°, following a mean of 38°·9.

It is interesting to note that the Greenwich temperature for last November was 48°·1, so that we should expect a very cold winter.

In conclusion, I should be very pleased if any of your readers thought it worth while testing this method with further values, and thus evolving perhaps a more scientific theory than mine.

C. RIDPATH.

THE SNOWDON GAUGE.

Col. Ward is doubtless sincere as to his friend's discovery of this gauge, but R. H. Scott in his "Meteorology," says it was invented by Quetelet and described by him in his "Climate of Belgium," published 1852.

JOHN J. GILBERT A.I.E E.

Crescent Wharf, Birmingham, January 19th, 1914.

THE IMPORTANCE OF A SNOWDON PATTERN GAUGE.

The recent heavy fall of snow, said to be the heaviest here for five years, has demonstrated in a striking way the importance of the deep funnel of a gauge of the "Snowdon" type. I set up a "British"

gauge in October by the side of a copper "Symons" gauge. The former and its measuring glass have British Rainfall Organization certificates, the latter has not, but its measuring glass though not certificated was supplied by Messrs. Negretti and Zambra, and seemed on comparison to agree fairly well with the other. The ring of the "British" gauge is 1 foot above ground, and that of the other 9 inches. I obtained the following readings:—

	British. in.	Symons. in.
December 28th	·11	·05
,, 29th	·42	·29
,, 30th	·18	·12

I admit the possibility of error in the figure ·05 in., though I think it unlikely, as I am most particular about writing down the quantity of water added to melt the snow, but the figures for the 29th and 30th are certainly right.

In the snow on January 4th and 5th I got the opposite effect:—

	Symons' Gauge. in.	British Gauge. in.
January 4th	·13	·12
,, 5th	·09	·07

The Symons is 9 ins. above ground, and the British 1 foot.

Under ordinary conditions the Symons' gauge reads somewhat higher, and it shows more "rain days" than the other. The copper gauge gave me more trouble to thaw than the British, owing to its freezing in the funnel more readily.

A. E. SWINTON.

Swinton House, Duns, Berwickshire, N.B.

DEPOSITS ON THE WET BULB.

THE linen on my wet bulb thermometer occasionally has an appreciable deposit of green and colourless crystals mixed with specks of carbon. Being curious to know the composition I submitted one of the pieces of linen to an analyst and he found the following salts present, viz., copper sulphate, sodium sulphate, also traces of iron, arsenic and sodium chloride. The water used in the glass vessel belonging to the thermometer is *rain water* taken from the rain gauge. I am now using *distilled* water, and after the linen has been in use about 3 weeks I will have it examined to see if a deposit of similar nature has been formed.

A westerly wind brings smoke from passing steamers over this place, whilst a south-easterly wind may be slightly impregnated by chemically laden smoke from Widnes (some 15 miles distant).

It would be interesting to learn the results of similar investigations made by other readers.

H. MONTGOMERY, F.R.Met.Soc.

"Myra," Blundellsands, 8th January, 1914.

RAINFALL TABLE FOR JANUARY, 1914.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	RAINFALL OF MONTH.	
					Aver. 1875—1909. in.	1914. in.
		° ′	° ′			
Camden Square	*London*	51 32	0 8	111	1·83	·55
Tenterden	*Kent*	51 4	*0 41	190	2·14	·71
Arundel (Patching)	*Sussex*	50 51	0 27	130	2·59	·56
Fawley (Cadland)	*Hampshire*	50 50	1 22	52	2·75	·68
Oxford (Magdalen College).	*Oxfordshire*	51 45	1 15	186	1·78	·49
Wellingborough (Croyland Abbey).	*Northampton*	52 18	0 41	174	1·89	·84
Shoeburyness	*Essex*	51 31	*0 48	13	1·33	·63
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	1·70	1·97
Geldeston [Beccles]	*Norfolk*	52 27	*1 31	38	1·53	1·77
Polapit Tamar [Launceston]	*Devon*	50 40	4 22	315	3·59	1·67
Rousdon [Lyme Regis]	,,	50 41	3 0	516	2·94	·84
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	2·33	·76
Church Stretton (Wolstaston)	*Shropshire*	52 35	2 48	800	2·51	1·01
Coventry (Kingswood)	*Warwickshire*	52 24	1 30	340	2·22	·88
Boston	*Lincolnshire*	52 58	0 1	11	1·54	1·63
Worksop (Hodsock Priory).	*Nottinghamshire*	53 22	1 5	56	1·70	·98
Macclesfield	*Cheshire*	53 15	2 7	501	2·66	2·36
Southport (Hesketh Park)	*Lancashire*	53 38	2 59	38	2·55	1·57
Arncliffe Vicarage	*Yorkshire, W.R.*	54 8	2 6	732	6·26	5·68
Wetherby (Ribston Hall)	,, ,,	53 59	1 24	130	1·89	1·11
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	1·70	1·85
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	1·90	2·13
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	13·44	12·13
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	3·65	2·11
Haverfordwest	*Pembroke*	51 48	4 58	90	4·69	2·24
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	3·91	3·70
Llandudno	*Carnarvon*	53 20	3 50	72	2·51	2·09
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	4·10	3·91
Marchmont House	*Berwick*	55 44	2 24	498	2·40	1·96
Girvan (Pinmore)	*Ayr*	55 10	4 49	207	4·78	3·76
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	3·53	3·20
Inveraray (Newtown)	*Argyll*	56 14	5 4	17	7·34	7·56
Mull (Quinish)	,,	56 34	6 13	35	5·55	4·69
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	2·01	1·45
Braemar	*Aberdeen*	57 0	3 24	1114	2·92	2·88
Aberdeen (Cranford)	,,	57 8	2 7	120	2·36	1·51
Cawdor	*Nairn*	57 31	3 57	250	2·28	2·53
Fort Augustus (S. Benedict's)	*E. Inverness*	57 9	4 41	68	5·58	3·98
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	9·42	10·11
Dunrobin Castle	*Sutherland*	57 59	3 56	14	2·75	3·35
Wick	*Caithness*	58 26	3 6	77	2·48	1·90
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	5·94	5·18
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	3·78	2·08
Nenagh (Castle Lough)	*Tipperary*	52 54	8 24	120	3·88	1·84
Ennistymon House	*Clare*	52 57	9 18	37	4·30	3·11
Gorey (Courtown House)	*Wexford*	52 40	6 13	80	3·19	1·09
Abbey Leix (Blandsfort)	*Queen's County*	52 56	7 17	532	3·15	1·55
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	2·14	1·00
Mullingar (Belvedere)	*Westmeath*	53 29	7 22	367	3·10	1·56
Crossmolina (Enniscoe)	*Mayo*	54 4	9 16	74	5·35	3·25
Cong (The Glebe)	,,	53 33	9 16	112	4·79	3·84
Collooney (Markree Obsy.)	*Sligo*	54 11	8 27	127	3·87	2·25
Seaforde	*Down*	54 19	5 50	180	3·41	1·58
Bushmills (Dundarave)	*Antrim*	55 12	6 30	162	3·19	1·89
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	3·46	2·52

RAINFALL TABLE FOR JANUARY, 1914—*continued.*

RAINFALL OF MONTH (*con.*)					RAINFALL FROM JAN. 1.					
Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1875—1909. in.	1914. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1875-1909. in.	STATION.
—1·28	30	·16	9	12	...	...	...	...	25·11	Camden Square
—1·43	33	·27	9	13	...	...	...	...	27·64	Tenterden
—2·03	22	·14	29	10	...	...	...	...	30·48	Patching
—2·07	25	·20	30	12	...	...	...	...	31·87	Cadland
—1·29	27	·21	4	9	...	...	...	...	24·58	Oxford
—1·05	45	·33	9	11	...	...	.	...	25·17	Croyland Abbey
— ·70	47	·29	9	11	...	...	...	...	19·28	Shoeburyness
+ ·27	116	·67	9	11	...	...	...	...	25·40	Westley
+ ·24	116	·69	10	17	..	...	...	...	23·73	Geldeston
—1·92	47	·34	3	16	...	...	...	...	38·27	Polapit Tamar
—2·10	29	·17	29	14	...	...	...	...	33·54	Rousdon
—1·57	33	·20	4	13	...	...	...	...	29·81	Stroud
—1·50	40	·27	4	12	...	...	...	...	32·41	Wolstaston
—1·34	40	·34	9	12	...	...	...	...	28·98	Coventry
+ ·09	106	·55	10	16	...	...	...	...	23·35	Boston
— ·72	58	·28	9	15	...	...	...	...	24·46	Hodsock Priory
— ·30	89	·44	4	16	...	...	...	...	34·73	Macclesfield
— ·98	62	·52	8	15	...	...	...	...	32·70	Southport
— ·58	91	1·01	4	21	...	...	...	...	61·49	Arncliffe
— ·78	59	·33	10	10	...	...	...	...	26·87	Ribston Hall
+ ·15	109	·43	10	18	...	...	...	...	26·42	Hull
+ ·23	112	·55	8	24	...	...	...	...	27·94	Newcastle
—1·31	90	2·85	24	15	...	...	...	...	129·48	Seathwaite
—1·54	58	·57	8	16	...	...	...	...	42·28	Cardiff
—2·45	48	·39	7	12	...	...	...	...	46·81	Haverfordwest
— ·21	95	·92	9	15	...	...	...	...	45·46	Gogerddan
— ·42	83	·53	9	15	...	...	...	...	30·36	Llandudno
— ·19	95	·95	24	16	...	...	...	...	43·47	Cargen
— ·44	82	·50	8	17	...	...	...	...	33·76	Marchmont
—1·02	79	·84	9	19	...	...	...	...	49·77	Girvan
— ·33	91	·48	4, 24	16	...	...	...	...	35·97	Glasgow
+ ·22	103	1·34	30	19	...	...	...	...	68·67	Inveraray
— ·86	85	·90	8	19	...	...	...	...	56·57	Quinish
— ·56	72	·35	9	15	...	...	...	...	28·64	Dundee
— ·04	99	·95	25	19	...	...	...	...	34·93	Braemar
— ·85	64	·38	8	18	...	...	...	...	32·73	Aberdeen
+ ·25	111	·70	25	12	...	...	...	...	29·33	Cawdor
—1·60	71	·93	25	15	...	...	...	...	44·53	Fort Augustus
+ ·69	107	1·47	30	19	...	...	...	...	83·93	Bendamph
+ ·60	122	·85	25	15	...	...	...	...	31·90	Dunrobin Castle
— ·58	77	·50	25	19	...	...	...	...	29·88	Wick
— ·76	87	1·26	31	20	...	...	...	...	54·81	Killarney
—1·70	55	·39	9	18	...	...	...	...	39·57	Waterford
—2·04	47	·40	31	14	...	...	...	...	39·43	Castle Lough
—1·19	72	·39	5	20	...	...	...	...	46·52	Ennistymon
—2·10	34	·19	9	14	...	...	...	...	34·99	Courtown Ho.
—1·60	49	·30	28	16	...	...	...	...	35·92	Abbey Leix
—1·14	47	·20	17	12	...	...	...	...	27·68	Dublin
—1·54	50	·35	4	15	...	...	...	...	36·15	Mullingar.
—2·10	61	·39	3	18	...	...	...	...	52·87	Enniscoe
— ·95	80	·66	8	16	...	...	...	...	48·90	Cong
—1·62	58	·33	26	16	...	...	...	...	42·71	Markree
—1·83	46	·30	5	15	...	...	...	...	38·91	Seaforde
—1·30	59	·40	5	14	...	...	...	...	37·56	Dundarave
— ·94	73	·45	4	17	...	...	...	...	39·38	Omagh

SUPPLEMENTARY RAINFALL, JANUARY, 1914.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	·92	XI.	Lligwy	2·27
,,	Ramsgate	1·15	,,	Douglas	2·80
,,	Hailsham	·87	XII.	Stoneykirk, Ardwell House...	3·03
,,	Totland Bay, Aston House...	·45	,,	Dalry, The Old Garroch.....	5·45
,,	Stockbridge, Ashley..	·52	,,	Beattock, Kinnelhead	5·60
,,	Grayshott	·82	,,	Langholm, Drove Road	5·22
III.	Harrow Weald, Hill House...	·76	XIII.	Meggat Water, Cramilt Lodge	3·09
,,	Caversham, Rectory Road ...	·67	,,	North Berwick Reservoir.....	2·04
,,	Pitsford, Sedgebrook.....	·95	,,	Edinburgh, Royal Observaty.	2·12
,,	Woburn, Milton Bryant.....	...	XIV.	Maybole, Knockdon Farm ...	3·32
,,	Chatteris, The Priory..... ...	1·56	XV.	Ballachulish House	6·51
IV.	Elsenham, Gaunts End	1·08	,,	Campbeltown, Witchburn ..	3·73
,,	Colchester, Hill Ho., Lexden	1·41	,,	Holy Loch, Ardnadam.....	7·03
,,	Ipswich, Rookwood, Copdock	1·49	,,	Islay, Eallabus	3·68
,,	Blakeney..... .	1·88	,,	Tiree, Cornaigmore	3·25
,,	Swaffham	1·67	XVI.	Dollar Academy	3·11
V.	Bishops Cannings	·59	,,	Balquhidder, Stronvar.....	7·22
,,	Wimborne, St. John's Hill ...	·67	,,	Glenlyon, Meggernie Castle..	6·15
,,	Ashburton, Druid House.. ...	1·62	,,	Blair Atholl	3·00
,,	Cullompton	·86	,,	Coupar Angus	1·79
,,	Lynmouth, Rock House	2·36	,,	Montrose, Sunnyside Asylum.	1·47
,,	Okehampton, Oaklands... ...	2·44	XVII.	Alford, Lynturk Manse	1·38
,,	Hartland Abbey.....	2·16	,,	Fyvie Castle	1·66
,,	Probus, Lamellyn.....	1·42	,,	Keith Station	3·44
,,	North Cadbury Rectory.....	·75	XVIII.	Alvey Manse.....	...
VI.	Clifton, Pembroke Road.....	1·33	,,	Loch Quoich, Loan	15·10
,,	Ross, The Graig	·67	,,	Drumnadrochit	4·56
,,	Shifnal, Hatton Grange.....	1·16	,,	Skye, Dunvegan	6·30
,,	Droitwich.....	·71	,,	Lochmaddy Bayhead	...
,,	Blockley, Upton Wold.....	·88	,,	Glencarron Lodge	10·28
VII.	Market Overton.....	1·48	XIX.	Invershin	2·01
,,	Market Rasen	1·07	,,	Melvich	3·34
,,	Bawtry, Hesley Hall	·88	,,	Loch Stack, Ardchullin	8·26
,,	Derby, Midland Railway.....	1·50	XX.	Skibbereen Rectory	3·51
,,	Buxton	3·29	,,	Dunmanway, The Rectory ..	4·86
VIII.	Nantwich, Dorfold Hall	1·79	,,	Glanmire, Lota Lodge, No. 1	2·28
,,	Chatburn, Middlewood	3·51	,,	Mitchelstown Castle.....	2·08
,,	Cartmel, Flookburgh	4·13	,,	Darrynane Abbey.....	3·59
IX.	Langsett Moor, Up. Midhope	2·81	,,	Clonmel, Bruce Villa	1·66
,,	Scarborough, Scalby	2·33	,,	Newmarket-on-Fergus, Fenloe	2·07
,,	Ingleby Greenhow	1·61	XXI.	Laragh, Glendalough	2·04
,,	Mickleton	4·20	,,	Ballycumber, Moorock Lodge	1·28
X.	Bellingham, High Green Manor	3·32	,,	Balbriggan, Ardgillan	·88
,,	Ilderton, Lilburn Cottage ...	1·87	XXII.	Woodlawn	2·71
,,	Keswick, The Bank.....	4·21	,,	Westport, St. Helens	2·83
XI.	Llanfrechfa Grange	1·81	,,	Dugort, Slievemore Hotel ...	4·37
,,	Treherbert, Tyn-y-waun	8·26	,,	Mohill Rectory	2·85
,,	Carmarthen, The Friary	2·96	XXIII.	Enniskillen, Portora.....	2·34
,,	Castle Malgwyn [Llechryd]...	2·00	,,	Dartrey [Cootehill]	1·63
,,	Crickhowell, Tal-y-maes.....	3·00	,,	Warrenpoint, Manor House ..	1·29
,,	New Radnor, Ednol	...	,,	Banbridge, Milltown	1·10
,,	Birmingham WW., Tyrmynydd	4·93	,,	Belfast, Cave Hill Road	3·10
,,	Lake Vyrnwy	...	,,	Glenarm Castle..... ...	2 85
,,	Llangyhanfal, Plâs Draw.....	2·02	,,	Londonderry, Creggan Res...	2·23
,,	Dolgelly, Bryntirion.....	7·16	,,	Dunfanaghy, Horn Head ...	3·26
,,	Bettws-y-Coed, Tyn-y-bryn...	5·39	,,	Killybegs	4·36

METEOROLOGICAL NOTES ON JANUARY, 1914.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—The driest January since 1892, when the R was ·50 in., but with a marked deficiency of sunshine. There were only 12 days with recorded sunshine, and of these only 4 had so much as 2 hours. Mean temp. 38°·2 or 0°·3 below the average. Duration of sunshine 15·7* hours. and of R 24·7 hours. Evaporation ·09 in. Shade max. 55°·6 on 9th; min. 20°·9 on 24th. F 16, f 23.

TENTERDEN.—A dry month, and the coldest January since 1908. Duration of sunshine 53·0† hours. Shade max. 54°·0 on 9th; min. 18°·0 on 24th. F 17, f 22.

TOTLAND BAY.—The least R for January in the past 26 years. Duration of sunshine 59·7* hours or 11·6 hours below the average. Mean temp. 38°·6 or 2°·1 below the average. Shade max. 51°·0 on 10th; min. 24°·8 on 24th. F 13, f 21.

PITSFORD.—Mean temp. 36°·7. R ·71 in. below the average. Shade max. 49°·3 on 4th; min. 19°·3 on 24th. F 17.

IPSWICH, COPDOCK.—A dull, dry month, excepting from 8th to 10th. Mean temp. 36°·3. Duration of sunshine 43* hours. Shade max. 55°·4 on 9th, the highest temp. recorded in January in 13 years; min. 22°·3 on 24th. F 16, f 24.

POLAPIT TAMAR.—Cold, sunless and dry. Shade max. 54°·6 on 10th; min. 19°·0 on 1st. F 13, f 18.

NORTH CADBURY.—The driest January in 18 years. An absolute drought lasted from 10th to 25th. On the 13 days from 11th to 23rd temp. never reached 40°, but the night frosts were not severe. Shade max. 54°·8 on 9th; min. 21°·5 on 1st. F 15, f 21.

WOLSTASTON.—Very cold from 11th to 25th, with E. wind, but mild and damp after.

HODSOCK PRIORY.—A dry, open month, with a good deal of calm, anticyclonic weather. Shade max. 54°·9 on 9th; min. 11°·4 on 1st. F 12, f 26.

SOUTHPORT.—Dry, but exceptionally dull. Duration of R 53·7 hours, and of sunshine only 26·1* hours or 19·2 hours below the average. Mean temp. 39°·3. Evaporation ·07 in. Shade max. 54°·0 on 31st; min. 22°·0 on 1st. F 11, f 19.

HULL.—Dull and cheerless generally. Cold periods, with sleet and S to 24th, then mild to the end. Duration of sunshine 21·8* hours. Shade max. 54°·0 on 31st; min. 23°·0 on 5th. F 9, f 21.

HAVERFORDWEST.—Fine and mild generally. Gales on 3 days. Duration of sunshine 39·0* hours. Shade max. 54°·1 on 25th and 31st; min. 21°·9 on 1st. F 10.

BETTWS-Y-COED.—Shade max. 63°·0 on 10th; min. 20°·0 on 1st.

CARGEN.—A week of unsettled weather from 4th to 10th, followed by a fortnight of fine but somewhat cold weather. A change of wind to the S. on 23rd brought with it another wet period accompanied by high winds. Farm work well advanced. Pastures extraordinarily green for mid-winter.

EDINBURGH.—Shade max. 53°·1 on 25th; min. 24°·9 on 1st. F 8, f 23.

LYNTURK.—Remarkably open weather. Mild at the beginning. R considerably below the average. Shade max. 53°·5 on 30th; min. 17°·0 on 21st. F 22.

LOCH STACK.—Duration of sunshine 19·3* hours.

DUNMANWAY.—Little R until 23rd, except on nights 7th, 8th and 9th. Dry, hard weather with E. winds prevailed. Wet and milder after 23rd. Wild and stormy on night of 30th and on 31st.

MARKREE.—The finest January for many years, with the lowest R.

KILLYBEGS.—Fine on the whole, with strong winds. Cold between 11th and 22nd.

* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, August, 1913.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity. 0-100	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°		°	°	inches		
London, Camden Square	82·6	28	45·2	25	72·2	53·2	53·7	78	127·3	43·6	1·43	11	6·7
Malta	93·9	20	67·9	17	82·6	71·8	...	71	146·8	..	·02	1	2·5
Lagos	86·2	*22	70·3	5	84·0	74·3	72·4	79	155·2	68·3	2·48	16	...
Cape Town	71·9	8	40·7	2	63·8	50·3	51·0	80	...	...	3·76	8	5·1
Natal, Durban ...	71·0	†23	49·0	‡15	67·0	58·1	56·5	78	...	...	7·12	5	5·0
Johannesburg	77·8	§ 21	27·5	14	68·2	45·5	35·5	59	132·0	26·8	·91	3	1·9
Mauritius	77·2	29	52·4	1	74·5	61·3	59·6	76	139·0	45·1	2·17	17	5·1
Bloemfontein	80·5	22	27·9	14	68·1	41·8	35·0	58	...	...	·36	3	3·7
Calcutta...	92·1	3	76·5	7	88·1	78·6	77·0	85	...	75·5	13·40	18	8·3
Bombay...	87·1	30	74·9	21	84·9	77·8	75·1	82	133·9	71·3	3·47	22	7·4
Madras	102·4	3	75·5	20	97·6	79·9	70·3	62	145·7	74·0	·72	9	6·5
Colombo, Ceylon ...	87·5	26	72·2	21	85·2	76·5	73·2	78	152·7	69·7	·64	6	7·2
Hongkong	92·0	16	74·9	17	86·5	77·7	76·1	84	...	...	10·57	15	5·8
Sydney	76·9	30	41·0	15	63·5	47·8	39·6	56	123·0	29·0	·11	7	2·8
Melbourne	65·7	29	30·7	14	57·0	44·5	41·4	68	113·3	26·5	1·85	21	6·8
Adelaide	74·8	14	39·7	31	63·9	47·9	43·3	64	132·0	31·1	2·11	17	5·0
Perth	67·6	31	39·9	20	62·1	48·0	47·6	75	139·1	32·9	9·89	26	5·9
Coolgardie	76·8	26	33·0	3	64·0	42·7	40·4	58	141·6	28·0	·66	6	3·2
Hobart, Tasmania ..	64·5	28	31·9	15	54·1	41·1	37·7	64	111·5	26·4	1·44	22	6·5
Wellington	62·4	23	36·2	9	55·0	44·5	43·8	80	117·6	28·0	4·30	25	7·5
Auckland	62·0	6	40·0	30	57·7	48·3	47·6	82	129·0	35·0	5·78	23	6·3
Jamaica, Kingston ..	93·2	26	70·8	19	89·8	73·2	71·2	77	...	...	1·08	11	4·0
Grenada	87·0	13	71·0	8	84·7	71·3	...	74	138·0	...	9·44	25	5·5
Toronto	92·0	‡17	42·2	25	78·8	58·5	56·5	70	...	...	2·27	9	3·6
Fredericton	86·5	16	36·0	26	74·2	51·0	...	76	...	...	4·02	9	4·2
St. John, N.B. ...	77·2	10	47·2	26	65·5	54·4	54·0	82	...	...	2·76	12	5·4
Edmonton, Alberta ...	83·8	3	41·0	19	71·0	49·6	...	73	141·8	35·5	4·41	17	5·1
Victoria, B.C.	85·8	1	46·0	19	72·1	53·0	52·0	71	...	...	·84	3	4·7

* 24, 27. † 26, 27, 30. ‡ 16. § 22.

Johannesburg.—Bright sunshine 298·5 hours.

Mauritius.—Mean temp. of air 0°·3 below, dew point 0°·4 above, and R ·31 in. below, averages. Mean hourly velocity of wind 12·4 miles, or ·1 above average.

Bloemfontein.—The warmest August since observations have been taken here.

COLOMBO.—Mean temp. of air 80°·9, or 0°·3 below, of dew point 0°·1 below, and R 2·29 in. below, averages. Mean velocity of wind 6·3 miles per hour.

HONGKONG.—Mean temp. of air 81°·6. Mean hourly velocity of wind 8·7 miles. Bright sunshine 197·8 hours.

Sydney.—Dry and frosty month.

Melbourne.—Mean temp. of air 2°·4 above, and R ·04 in. above, averages.

Adelaide.—Mean temp. of air 2°·1 above, and R ·39 in. below, averages.

Coolgardie.—Temp. of air normal.

Hobart.—Temp. of air normal and R ·39 in. below, averages.

Wellington.—Mean temp. of air 1°·3 below, and R ·36 in. below, averages. Bright sunshine 115·0 hours.

Auckland.—Wet and stormy, R on 23 days. Gales on 12th, 20th, and 25th.